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Department of Construction Services



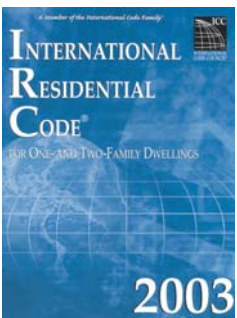
**Residential Code Requirements**  
**Exhaust, Ventilation**  
**&**  
**Duct Systems**  
**Moving from 2003 IRC to 2009 IRC**

Presented by  
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Assistant Director  
December 2011

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**Based Upon**


- **2003 IRC**
  - Sections in reference to:
    - Ventilation
    - Exhaust
    - Duct Systems
  - As amended by the 2005 Amendment to the Connecticut Supplement



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**Based Upon**

- **2009 IRC**
  - Sections in reference to:
    - Ventilation
    - Exhaust
    - Duct Systems
  - As amended by the pending 2011? Amendment to the Connecticut Supplement



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### **Course Objectives**

- **Construction Changes that effects ventilation, exhaust and ducts.**
- **Review of Code Definitions**
- **What Are The Residential Code Requirements For**
  - **Ventilation**
  - **Exhaust**
  - **Duct Systems**
- **How Does 2009 IRC requirements differ from 2003 IRC requirements**

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### **Course Objectives**

- Ventilation, Exhaust, Duct Systems**
- **How Do Each Of These Systems**
    - **Interact with each other**
      - **As directed by the 2009 IRC compared to 2003**
      - **In overall**
        - **Operation**
        - **Comfort**
        - **Indoor Air Quality**

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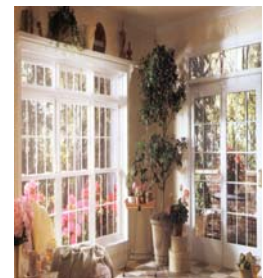
### **Ventilation**

- **What Is It?**
  - **According to Chapter 2, Section R202 definitions**
    - **VENTILATION:**
      - **The natural or mechanical process of supplying conditioned or unconditioned air to, or removing such air from, any space**

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### **Natural Ventilation**

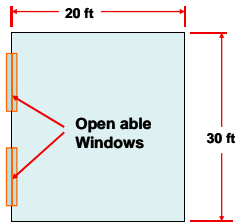
- **When Can We Use Natural Ventilation?**
  - **Section R303.1**
    - **Minimum open able area to the outdoors**
      - **4% of the floor area being ventilated**



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### 4% Example #1

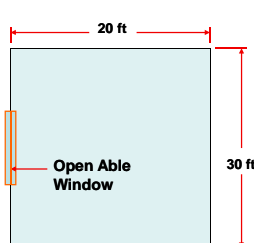


Open able window dimension of  
48" w x 48" h = 2304 sq in = 16 sq ft  
2 windows x 16 sq ft = 32 sq ft

- **Applying R303.1**
  - 20' x 30' = 600 sq ft
  - 4% Of Floor Area
    - **Minimum open able area equals**
      - 4% x 600 =
      - .04 x 600 = 24 sq ft
  - 32 sq ft open able area (vs.) minimum of 24 sq ft
- **Windows Meet Code Requirements**

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### 4% Example #2



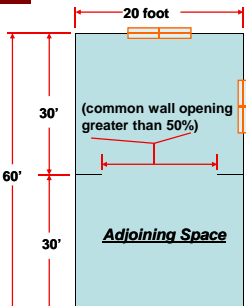
Open able window dimension of  
48" w x 36" h = 1728 sq in = 12 sq ft

- **Applying R303.1**
  - 20' x 30' = 600 sq ft
  - 4% Of Floor Area
    - **Minimal open able area equals**
      - 600 x 4% =
      - 600 x .04 = 24 sq ft
  - 12 sq ft operable area (vs.) minimum of 24 sq ft
- **Window Does Not Meet Code Requirement**

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### Adjoining Spaces

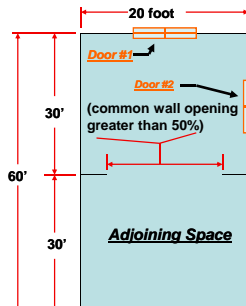
- **An Adjoining Room**
  - **Section R303.2**
    - **When ½ or greater of the common wall is open and unobstructed**
    - **Opening not less than 1/10 of the floor area**
      - Of the interior room
      - Not less than 25 square feet



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### Adjoining Spaces #1

- **Required Opening**
  - **Total of both rooms**
    - 60' X 20' = 1200 sq ft
    - 4% of area =
    - 1200 X .04 = 48 sq ft
- **Open Able Area**
  - **Door = 4' X 7' = 28 sq ft**
    - 28 sq ft per door X 2 doors
    - 56 Sq Ft
  - **56 Actual (vs.) 48 required**
    - **Code Requirement is Met**



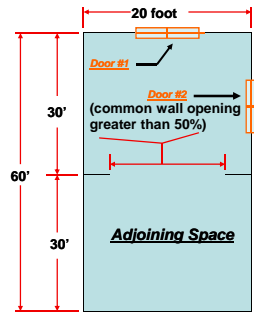
Glass Doors on 20' wall - Measurement of 48" w X 84" h - Open able area  
Glass Doors on 30' wall - Measures 48" w X 84" h - Open able area

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### Adjoining Spaces #2

- **Required Opening**
  - **Total of both rooms**
    - $60' \times 20' = 1200 \text{ sq ft}$
    - 4% of area =
      - $1200 \times .04 = 48 \text{ sq ft}$
  - **Open Able Area**
    - Door =  $3' \times 7' = 21 \text{ sq ft}$ 
      - $21 \text{ sq ft per door} \times 2 \text{ doors}$
      - $42 \text{ sq ft}$
    - **42 Actual (vs.) 48 required**
      - **Code Requirement is NOT Met**



Glass Doors on 20' wall - Measurement of 36" w X 84" h - Open able area

Glass Doors on 30' wall - Measures 36" w X 84" h - Open able area

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### Bathroom Ventilation

- **Section R303.3 Bathrooms**
  - **Aggregate Glazing Area**
    - **Of not less than 3 sq ft, in windows**
      - ½ of which must be open able



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### Crawl Space Ventilation

- **Where Required**
  - **Section R408.1 Ventilation**
    - **Under-floor space between the**
      - Bottom of the floor joists and the earth
        - » Shall be provided with ventilation openings
    - **Minimum net area of ventilation openings**
      - **Not to be less than**
        - 1 square foot for every 150 square feet
    - **One opening to be**
      - **Within 3 feet of each corner**

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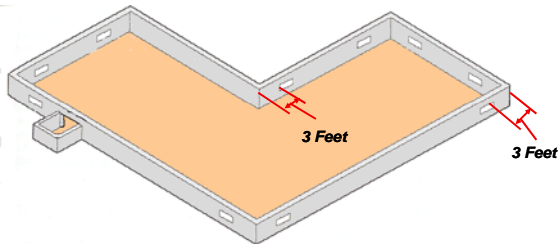
### Crawl Space Ventilation

- **Where Required (New for 2009 IRC)**
  - **Section R408.1 Ventilation**
    - **When the Ground surface is covered by Class 1 Vapor Retarder Material (0.1 perm or less)**
    - **Minimum net area of ventilation openings**
      - **Not to be less than**
        - **1 square foot for each 1,500 square feet**
    - **One opening to be**
      - **Within 3 feet of each corner**

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### Crawl Space Ventilation



Ventilation Opening Shall Be Within 3 Feet Of Each Corner Of The Building

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### Ventilation Openings

- **Openings To Be Covered For**

- Height & width

- Section R408.2

- **Materials**

- Perforated sheet metal plates
- Expanded sheet metal plates
- Cast iron grills
- Extruded load bearing brick vents
- Hardware Cloth
- Corrosion resistant wire mesh

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### Opening Exceptions

- **Natural Ventilation**

- Climatic conditions

- Opening reduction

- With approved vapor barrier
- Cross ventilation provided

- Space used as supply plenum

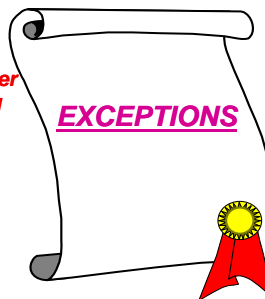
- For heating or cooling

- Mechanical ventilation

- Rate of 1.0 cfm / 50 sq ft

- No ventilation openings

- Approved vapor retarder
- Space is supplied with conditioned air



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### Exception #5

- **No Openings Required When**

- Ground is covered with an approved vapor retarder

- Perimeter walls are insulated

- Refers over to

- Section N1102.1.7 Crawl Space Walls

- Insulation requirements per Table 1102.1

- Exposed earth

- » Continuous vapor retarder
- » Maximum permeance of 1.0

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### 2003 Table Is Set Up By Climate Zones

**CT Uses Zones 12, 13, 14**

TABLE N1102.1  
SIMPLIFIED PRESCRIPTIVE BUILDING ENVELOPE THERMAL COMPONENT CRITERIA  
MINIMUM REQUIRED THERMAL PERFORMANCE (U-FACTOR AND R-VALUE)

BUILDING LOCATION		MAXIMUM GLAZING U-FACTOR (Btu / (hr·ft <sup>2</sup> ·°F))	MINIMUM INSULATION R-VALUE ((hr·ft <sup>2</sup> ·°F) / Btu)					
Climate Zone	HDD		Ceilings	Walls	Floors	Basement walls	Slab perimeter R-value and depth	Crawl space walls
12	5,500-5,999	0.40	R-38	R-18	R-21	R-10	R-9, 4 ft.	R-19
13	6,000-6,499	0.35	R-38	R-18	R-21	R-10	R-9, 4 ft.	R-20
14	6,500-6,999	0.35	R-49	R-21	R-21	R-11	R-11, 4 ft.	R-20

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### 2009 Table Is Set Up By Climate Zones

**CT Uses Zone 5**

Table N1102.1  
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT

CLIMATE ZONE	FENESTRATION U-FACTOR*	SKYLIGHT* U-FACTOR	GLAZED FENESTRATION** SHGC	CEILING R-VALUE	WOOD FRAME WALL R-VALUE	MASS WALL R-VALUE	FLOOR R-VALUE	BASEMENT WALL R-VALUE	SLAB* R-VALUE & DEPTH	CRAWL SPACE WALL R-VALUE
1	1.20	0.75	0.30	30	13	3 / 4	13	0	0	0
2	0.65 <sup>†</sup>	0.75	0.30	30	13	4 / 6	13	0	0	0
3	0.50 <sup>†</sup>	0.65	0.30	30	13	5 / 8	19	5 / 13 <sup>‡</sup>	0	5 / 13
4 except Marine 4	0.35	0.60	NR	38	13	5 / 10	19	10 / 13	10, 2ft	10 / 13
5 and Marine 4	0.35	0.60	NR	38	20 or 13+5 <sup>†</sup>	13 / 17	30 <sup>§</sup>	10 / 13	10, 2 ft	10 / 13
6	0.35	0.60	NR	49	20 or 13+5 <sup>†</sup>	15 / 19	30 <sup>§</sup>	15 / 19	10, 4 ft	10 / 13
7 and 8	0.35	0.60	NR	49	21	19 / 21	38 <sup>§</sup>	15 / 19	10, 4 ft	10 / 13

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### Attic / Roof Ventilation

#### • **Ventilation Required – Section R806.1**

(As per 2005 Amendments to CT Supplement)

##### – **Cross ventilation necessary**

##### • **Ventilation to be from openings protected from the elements**

- With corrosion resistant wire mesh
- 1/8 to 1/4 inch maximum openings

#### • **Minimum Area - Section R806.2**

##### – **Not less than 1 to 150 of the area**

##### • **Reduction to 1 to 300**

- With ventilators providing 50 to 80%
- Of required ventilation



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### Vent Clearance

#### • **Installation Of Eave Or Cornice Vents**

– **Insulation is not to block the free flow of air**

##### • **Minimum space of 1 inch**

- To be provided between insulation and roof sheathing

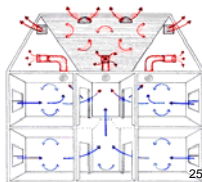


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### **Necessity Of Mechanical Ventilation & Exhaust Systems**

- **Our Areas Of Discussion On Natural Ventilation**
  - Have shown that when the code requirements for Natural Ventilation cannot be met
    - Mechanical Ventilation is necessary
- **Reference To:**
  - R303 Light Ventilation & Heating
  - R408 Under Floor space



### **Definitions Relating To Mechanical Ventilation & Exhaust**

- **How Does The Code Look At Mechanical Systems?**
  - **Mechanical Exhaust System**
    - A system for removing air from a room or space by mechanical means
  - **Mechanical System**
    - A system specifically addressed and regulated in this code and composed of components, devices, appliances and equipment

### **Definitions Relating To Mechanical Ventilation & Exhaust**

- **Continuation**
  - **Ventilation**
    - The natural or mechanical process of supplying conditioned or unconditioned air to, or removing such air from, any space
      - (This is the same definition we looked at previously)
  - **NOTE:**
    - Ventilation and venting are two separate processes
      - Venting is the removal of combustion products to the outdoors

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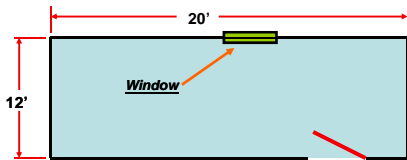
### **Mechanical Ventilation For Habitable Rooms**

- **When Natural Ventilation Does Not Meet The Requirements Of R303.1**
  - **Exception #1**
    - Applies for the use of Mechanical Ventilation
      - It can be broken down into two parts
  - **Part 1**
    - An approved mechanical ventilation system
      - Capable of 0.35 air changes/ hour
      - Within the room

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### Example For Part 1



- **Application:**

- **Room is:**

- $12'w \times 20'l \times 8'h = 1920 \text{ cu ft}$
    - $0.35 \text{ air change / hour} = 35\%$ 
      - $.35 \times 1920 \text{ cf} = 672 \text{ cfh}$
      - $672 \text{ cfh} / 60 \text{ min} = 11.2 \text{ cfm}$

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### Second Portion Of Exception

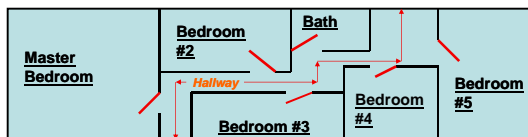
- **Part 2**

- **When a whole house mechanical ventilation system is used**

- **It is to be capable of supplying outdoor ventilation at**
      - 15 cubic feet per minute / occupant
    - **Computation base**
      - 2 occupants for first bedroom
      - 1 occupant for each additional bedroom

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### Example For Part 2



- **5 Bedroom Home**

- Master = 2 occupants
  - #2 = 1 occupant
  - #3 = 1 occupant
  - #4 = 1 occupant
  - #5 = 1 occupant
  - Total occupant load =  $6 \times 15 \text{ cfm} = 90 \text{ cfm}$ 
    - 90 cfm whole house mechanical ventilation is necessary

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### Mechanical Ventilation For Bathrooms

- **Section R303.3 Bathrooms**

- **When the natural ventilation requirements for bathrooms cannot be met**

- **The Exception would apply for mechanical ventilation**
    - **Minimum ventilation rates of**
      - 50 cfm intermittent
      - 20 cfm continuous
    - **All exhausting must be to the exterior of the building**



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### Additional Code Sections

- **Section M1506 Mechanical Ventilation**
  - *Sets up overlapping sections with R303.3*
    - **First**
      - Exhaust air from bathrooms and toilet rooms shall not be recirculated within a residence or to another dwelling
    - **Second**
      - Exhaust systems shall have the capacity to exhaust the minimum air flow rate
        - » As per Table M1506.3

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### Referenced Table

TABLE M1506.3  
MINIMUM REQUIRED EXHAUST RATES FOR  
ONE- AND TWO-FAMILY DWELLINGS

AREA TO BE VENTILATED	VENTILATION RATES
Kitchens	100 cfm intermittent or 25 cfm continuous
Bathrooms—Toilet Rooms	Mechanical exhaust capacity of 50 cfm intermittent or 20 cfm continuous

For SI: 1 cubic foot per minute = 0.0004719 m<sup>3</sup>/s.

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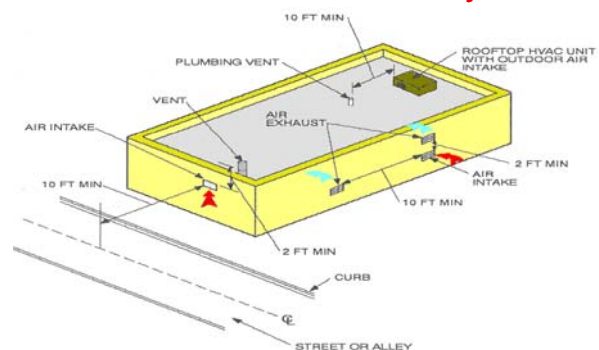
### Opening Locations

- **Intake Openings R303.4.1**
  - *Minimum requirements for intake openings of natural and mechanical*
    - 10 feet from hazardous or noxious contaminant
    - If within 10 feet of a source
      - Locate opening a minimum of 2 feet below the contaminant source
  - *Dwelling unit exhaust, Bathroom exhaust and Kitchen exhaust*
    - Are not considered to be hazardous or noxious

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### Figure R303.4.1

*From 2003 IRC Commentary*



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### **Exhaust Location**

- **Exhaust Openings R303.4.2**
  - **Location of exhaust openings not to create a nuisance**
    - **What Does The Code Consider To Be A Nuisance**
      - Dangerous to human life
      - Detrimental to health
      - Worse than bothersome
  - **No direction of exhaust air to walkways**

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### **Opening Protection**

- **Outside Opening Protection R303.5**
  - **To be provided with corrosion resistant**
    - **Screens, Louvers or Grills**
  - **Minimum opening**
    - **Of ¼ inch**
  - **Maximum opening**
    - **Of ½ inch**



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### **Underfloor Mechanical Ventilation**

- **Exception #4**
  - **Of Section R408.2**
    - **Allows for mechanical ventilation**
  - **With continuous mechanical ventilation**
    - **At a rate of 1.0 cfm**
      - For each 50 sq ft of underfloor space
    - **Ground surface to be covered with an approved vapor retarder material**

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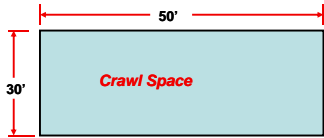
### **What Is The Difference**

- **Vapor Permeable Membrane:**
  - **A material of covering having a permeance rating of 5 perms or greater, when tested in accordance with the desiccant method using Procedure A of ASTM E96.**
    - **A vapor permeable material permits the passage of moisture vapor**
- **Vapor Retarder:**
  - **A vapor resistant material, membrane or covering such as foil, plastic sheeting, or insulation facing having a permeance rating of 1 perm or less, when tested in accordance with the desiccant method using Procedure A of ASTM E96.**
    - **Vapor retarders limit the amount of moisture vapor that passes through a material or wall assembly**

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**Example**



30'  
50'  
Crawl Space

- **Crawl Space** = 50' long X 30' wide =
  - 1500 Square Ft
  - 1500 sq ft / 50 sq ft = 30
  - 30 X 1.0 cfm = 30 cfm
- **Answer:**
  - 30 cfm of Mechanical Ventilation is needed

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**Exception #4 Continued**

- **When Exception #4 Is Used**
  - You must also comply with the code requirements of
    - **Section N1102.7 Crawl Space Walls**
      - "... Insulation shall be installed on crawl space walls when the crawl space is not vented to the outside air. The required R-value in Table N1102.1 shall be applied..."

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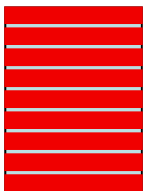
**Hydrogen Generation & Refueling Operations**

- **Natural Ventilation**
  - Section M1307.4.1
    - For indoor operations
      - Minimum opening size of 3 inches
- **Two Openings Required**
  - Section M1307.4.2
    - One entirely within 12" of the ceiling
    - One entirely within 12" of the floor

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**Ventilation Openings**

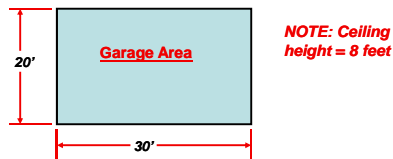
- **Each Opening Must Go**
  - Directly to the outdoors
    - Horizontally
    - ½ sq ft / 1000 cu ft of garage volume
- **Louvers & Grills**
  - M1307.4.1.2
    - Opening based on net free area
    - Less
      - 25% for metal louvers
      - 75% for wood louvers



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### Example #1



- **Garage Area**
  - 1.  $20'w \times 30'l \times 8'h = 4800 \text{ cu ft}$
  - 2.  $4800 \text{ cu ft} / 1000 = 4.8$ 
    - Since  $\frac{1}{2}$  square foot = 72 square inches
      - $4.8 \times 72 = 345.6 \text{ sq in.}$
      - $345.6 / 144 = 2.4 \text{ sq ft}$
  - 3. **2.4 sq ft of minimum free area required**

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### Mechanical Ventilation For Hydrogen Operations

- **Indoor Locations For Hydrogen Generating Or Refueling Operations**
  - To be mechanically ventilated as per
    - Section 502.16 of the 2003 IMC
  - Ventilation rate of
    - 1 cu ft / min (for each) 12 cu ft of room volume
  - Mechanical operation to be continuous
    - Unless interlocked with gas detection system

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### Engineered Installations

- **Section M1307.4.3**
  - Specially Engineered Installations
    - It sets up the supply of ventilation air
      - By use of an approved engineered system
  - It sets up a performance code
    - For new system development



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### Exhaust Systems

#### **2009 IRC - Section M1501**

- Section 1501.1 Outdoor discharge
  - Air removed by every mechanical exhaust system shall be discharged to the outdoors
    - Air shall not be exhausted into an attic, soffit, ridge vent or crawl space.
      - Exception: Whole house ventilation-type attic fans that discharge into the attic space of dwelling units having private attics shall be permitted.

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## **Clothes Dryer Exhaust** **2009 IRC Section M1502**

Formerly Section M1501 - 2003 IRC

- **Section M1502.1 General**
  - Exhausted according to Manufacturer's Instructions
- **Section M1502.2 Independent exhaust systems**
  - Exhaust is to be independent and terminate outdoors
- **Section M1502.3 Duct Termination**

Duct termination is to

  - Terminate not less than 3 feet in any directions from openings
  - Be equipped with a backdraft damper
  - No screens in duct termination

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## **Dryer Exhaust Ducts** **2009 IRC**

### **Section M1502.4 Dryer Exhaust Ducts**

- **M1502.4.1 Material and size**
  - Smooth interior finish
  - Minimum of 0.016" thick rigid metal
  - 4 inches nominal diameter
- **M1502.4.2 Duct installation**
  - Supported at 4 foot intervals and secured in place
  - Joints to run in the direction of air flow
  - No fasteners to extend into duct
- **M1502.4.3 Transition duct**
- **M1502.4.4 Duct length**
- **M1502.4.5 Length identification**

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## **Dryer Exhaust Ducts**

### **M1502.4.6 Exhaust ducts required**

- Where space for clothes dryer is provided.
- **Exception**
  - Does not apply to condensing (ductless) dryers

### **M1502.4.3 Transition duct**

#### • **Transition Duct Requirements**

- Limited to a single length
  - Not to exceed 8 feet
- To be listed and labeled UL 2158A
- Not to be concealed



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## **Exhaust Duct**

### **M1502.4.4 Duct length (2009 IRC)**

- **M1501.4.4.1 Specified Length**
  - Not to exceed 25 feet in length
  - Reduced in accordance to Table M1502.4.4.1
- **M1501.4.4.2 Manufacturer's instructions**
  - Size and Length as per MFG installation instruction

### **Length Limitation 2003 IRC**

- **Section M1501.3**
  - Not to exceed 25 feet in length
    - Does not include the transition
  - Restriction reductions
    - 45 degree = 2.5 feet
    - 90 degree = 5 feet



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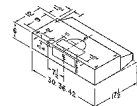
### **Dryer Exhaust Ducts**

- **M1502.4.5 Length identification**
  - **Where concealed within building construction**
    - Exhaust duct shall be identified on permanent label or tag
    - Label or tag shall be located within 6 feet of duct connection.
- **M 1502.5 Protection Required**
  - **Protective shield plates shall be placed where nails or screws likely to penetrate**
    - Less than 1.25 inches (between duct & finish surface)
    - Minimum thickness 0.062 inch steel
    - Extend 2 inches above sole plate and below top plate

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### **Range Hoods** **2009 IRC Section M1503**

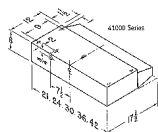
- **General Section M1503.1**
  - **All ducted range hoods are to discharge to the outdoors, through a single wall duct**
    - **No termination in**
      - Attic
      - Crawl Space
      - Inside of Building
    - **Wall duct**
      - Smooth interior finish
      - Air tight
      - Equipped with backdraft damper



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### **Exception** **Range hood discharge**

- **Listed & Labeled Ductless (Recirculating )Range Hoods**
  - **Are not required to exhaust outdoors**
  - **When**
    - Installed as per MFG Installation Instructions
    - Mechanical or Natural ventilation is provided



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### **Range Hood Duct Materials**

- **Section M1503.2 Duct Material**
  - **Single wall ducts for range hoods are to be constructed of**
    - Galvanized steel, Stainless steel, Copper
  - **Exception**
    - Downdraft exhaust systems using
      - Schedule 40 PVC



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### **Downdraft Exception**

#### **Exception to M1503.2**

- **When Schedule 40 PVC Is Used**
  - **Installation must meet all of the requirements**
    - **Duct to be installed under a concrete slab poured on grade**
    - **Trench to be backfilled with sand or gravel**
    - **Duct extension above indoor concrete floor**
      - **Maximum of 1 inch**
    - **Duct extension above outdoor grade**
      - **Maximum of 1 inch**
    - **Ducts are to be solvent cemented**

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### **Range Hoods**

- **M 1503.3 Kitchen exhaust rates**
  - Fans shall be sized in accordance to M1507.3
- **M 1503.4 Makeup air required**
  - Exhaust hood systems exhausting in excess of 400 cubic feet per minute
    - Shall be provided with makeup at +/- equal rate
    - Makeup air systems equipped with means of closure and automatic controls to start and operate simultaneously with exhaust system

58

### **Microwave Oven Installation**

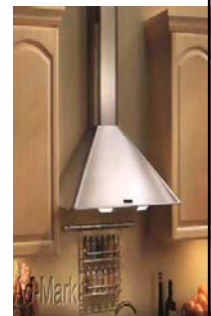


- **Installation Of Microwave Oven Over A Cooking Appliance**
  - **Section M1504.1**
    - **Unit is to be listed and labeled**
    - **Installation to be in conformance with**
      - **Listing and labeling**
      - **Manufacturers Installation Instructions**

59

### **Overhead Exhaust Hoods**

- **Section M1505.1**
  - **Domestic open-top broiler units**
    - **To be provided with a metal exhaust hood**
      - **Minimum of 28 gage**
    - **0.25 inch clearance to combustible materials**
    - **Minimum clearance from cooking surface of**
      - **24 inches**



60





### Minimum Dimensions

- **Besides The 24" Minimum Clearance**
  - To the cooktop surface
- **Unit is to be**
  - As wide as the cook-top
  - Extend over the cook-top
- **System Must Meet Requirements For**
  - Outside termination
  - Backdraft damper
    - For control of infiltration & exfiltration

61

### Mechanical Ventilation


#### 2009 IRC Section M1507

- M 1507.2 Recirculation of Air:
  - Exhaust Air from toilet rooms and bathrooms shall not be recirculated
  - Exhaust Air from toilet rooms and bathrooms shall not discharge into attic, crawl space or other airs inside building
- M 1507.3 Ventilation Rate: Table M1507.3

AREA TO BE VENTILATED	VENTILATION RATES
Kitchens	100 cfm intermittent or 25 cfm continuous
Bathrooms-Toilet Rooms	Mechanical exhaust capacity of 50 cfm intermittent or 20 cfm continuous

62

## **Short Break**



63

### Chapter 16

### Duct Systems

- **Terms And Definitions**
  - **Duct System**
    - A continuous passageway for the transmission of air which, in addition to ducts includes duct fittings, dampers, plenums, fans and accessory air-handling equipment and appliances.
  - **Plenum**
    - A chamber that forms apart of an air-circulation system other than the occupied space being exhausted.

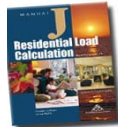
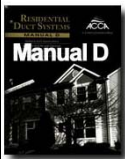
64



## Duct Construction

- **Duct Design Section M1601.1**

- When serving heating, cooling & ventilation equipment
- Fabrication to follow
  - This chapters provisions &
  - ACCA Manual D
    - Or other approved methods



65

## Type Of Duct Systems

- The Chapter Breaks Them Down Into
  - Above ground duct systems
    - Section M1601.1.1
  - Underground duct systems
    - Section M1601.1.2



66



## Above Ground Duct Systems

- **Seven Code Requirements**
  - Discharge Air Temperature
    - Limited to 250 degrees F.
  - Factory Made Duct Material
    - To be Class 0 or Class 1 materials

TABLE M1601.1.1(1)  
CLASSIFICATION OF FACTORY-MADE AIR DUCTS

DUCT CLASS	MAXIMUM FLAME-SPREAD RATING
0	0
1	25

67

- **What Are These Ratings?**
  - Flame Spread
    - The propagation of flame over a surface
  - Flame Spread Index
    - The numerical value assigned to a material tested in accordance with ASTM E84
- **An Additional Area Of Reference**
  - NFPA 255
    - Standard method of test of surface burning characteristics of building materials

68



### Above Ground Duct

- Fibrous duct is to conform to
  - **SMACNA or NAIMA standards**
- Minimum thickness of metal duct
  - **As per Table M1601.1.1(2)**

TABLE M1601.1.1(2)  
GAGES OF METAL DUCTS AND PLENUMS USED FOR HEATING OR COOLING

TYPE OF DUCT	SIZE (inches)	MINIMUM THICKNESS (inches)	EQUIVALENT GALVANIZED SHEET GAGE	APPROXIMATE ALUMINUM B & S GAGE
Round ducts and enclosed rectangular ducts	14 or less	0.013	30	26
	over 14	0.016	28	24
Exposed rectangular ducts	14 or less	0.016	28	24
	over 14	0.019	26	22

From: 2003 IRC

TABLE M1601.1.1(2)  
GAGES OF METAL DUCTS AND PLENUMS USED FOR HEATING OR COOLING

DUCT TYPE	MINIMUM THICKNESS (inches)	EQUIVALENT GALVANIZED SHEET GAGE	APPROXIMATE ALUMINUM B & S GAGE
Round ducts and enclosed rectangular ducts			
14 inches or less	0.013	30	0.0475
16 and 18 inches	0.016	28	0.0575
20 inches and larger	0.019	26	0.0675
Exposed rectangular ducts			
14 inches or less	0.016	28	0.0475
Over 14 inches	0.019	26	0.0675

From:  
2009 IRC

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### Above Ground Duct

- Gypsum products may only be used for construction of return ducts and plenums
  - **Air temp not to exceed 125 degrees F**
  - **Exposed surface not to be subject to condensation**
- Duct system construction materials flame spread index
  - **Not to be greater than 200**
- Stud wall cavities & floor joist spaces to be used as return air plenums
  - **Must meet four criteria**

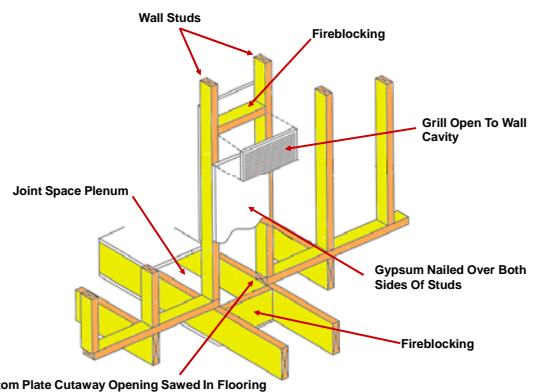
70

### Wall Cavities & Joist Spaces Criteria

- **All Of The Following Must Be Met**
  - May not be used for supply air
  - May not be part of a required
    - **Fire resistance rated assembly**
  - Wall cavity use not to convey air
    - **From more than one floor level**
  - Space isolation from adjacent concealed spaces
    - **Using tight fitting fire block**
      - **As per Section R602.8**

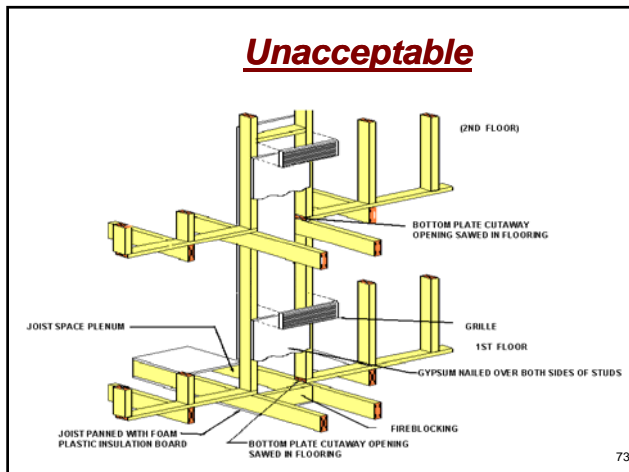
71

### Acceptable Installation



72





**Underground Duct**

- **Underground Duct Systems M1601.1.2**
  - **Construction Materials**
    - **Concrete, Clay, Metal, Plastic**
  - **Maximum Temperature**
    - **150 degrees F. for plastic duct**
  - **Metal duct to be protected from corrosion**
    - **In an approved manner**
    - **Or encased in 2" of concrete, minimum**
  - **Installation of non-metallic duct**
    - **Follow MFG installation instructions**

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**Manufactured Duct**

- **Factory-Made Ducts – Section M1601.2**
  - **Must be**
    - **Listed – labeled, approved for their intended use**
    - **Installation per MFG installation instructions**

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**Duct & Connector Labeling**

Flexible Air Duct Label Representation

Flexible Air Connector Label Representation

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**AMERICAN SOCIETY OF MECHANICAL ENGINEERS**  
INTERNATIONAL ASSOCIATION OF BRIDGE AND STRUCTURAL ENGINEERS

**INSTALLATION INSTRUCTIONS**  
Air Ducts and Air Connections  
INSULATED, WELD FLARE ENDS

**SECTION 1-1**

1. 1/2" (12.7 mm) Outside Diameter  
1. 1/2" (12.7 mm) Outside Diameter

**1. 1/2" (12.7 mm) Outside Diameter**

1. 1/2" (12.7 mm) Outside Diameter

**SECTION 2-2**

2. 1/2" (12.7 mm) Outside Diameter  
2. 1/2" (12.7 mm) Outside Diameter

**2. 1/2" (12.7 mm) Outside Diameter**

2. 1/2" (12.7 mm) Outside Diameter

**SECTION 3-3**

3. 1/2" (12.7 mm) Outside Diameter  
3. 1/2" (12.7 mm) Outside Diameter

**3. 1/2" (12.7 mm) Outside Diameter**

3. 1/2" (12.7 mm) Outside Diameter

**SECTION 4-4**

4. 1/2" (12.7 mm) Outside Diameter  
4. 1/2" (12.7 mm) Outside Diameter

**4. 1/2" (12.7 mm) Outside Diameter**

4. 1/2" (12.7 mm) Outside Diameter

**SECTION 5-5**

5. 1/2" (12.7 mm) Outside Diameter  
5. 1/2" (12.7 mm) Outside Diameter

**5. 1/2" (12.7 mm) Outside Diameter**

5. 1/2" (12.7 mm) Outside Diameter

**SECTION 6-6**

6. 1/2" (12.7 mm) Outside Diameter  
6. 1/2" (12.7 mm) Outside Diameter

**6. 1/2" (12.7 mm) Outside Diameter**

6. 1/2" (12.7 mm) Outside Diameter

**SECTION 7-7**

7. 1/2" (12.7 mm) Outside Diameter  
7. 1/2" (12.7 mm) Outside Diameter

**7. 1/2" (12.7 mm) Outside Diameter**

7. 1/2" (12.7 mm) Outside Diameter

**SECTION 8-8**

8. 1/2" (12.7 mm) Outside Diameter  
8. 1/2" (12.7 mm) Outside Diameter

**8. 1/2" (12.7 mm) Outside Diameter**

8. 1/2" (12.7 mm) Outside Diameter

**SECTION 9-9**

9. 1/2" (12.7 mm) Outside Diameter  
9. 1/2" (12.7 mm) Outside Diameter

**9. 1/2" (12.7 mm) Outside Diameter**

9. 1/2" (12.7 mm) Outside Diameter

**SECTION 10-10**

10. 1/2" (12.7 mm) Outside Diameter  
10. 1/2" (12.7 mm) Outside Diameter

**10. 1/2" (12.7 mm) Outside Diameter**

10. 1/2" (12.7 mm) Outside Diameter

**SECTION 11-11**

11. 1/2" (12.7 mm) Outside Diameter  
11. 1/2" (12.7 mm) Outside Diameter

**11. 1/2" (12.7 mm) Outside Diameter**

11. 1/2" (12.7 mm) Outside Diameter

**SECTION 12-12**

12. 1/2" (12.7 mm) Outside Diameter  
12. 1/2" (12.7 mm) Outside Diameter

**12. 1/2" (12.7 mm) Outside Diameter**

12. 1/2" (12.7 mm) Outside Diameter

**SECTION 13-13**

13. 1/2" (12.7 mm) Outside Diameter  
13. 1/2" (12.7 mm) Outside Diameter

**13. 1/2" (12.7 mm) Outside Diameter**

13. 1/2" (12.7 mm) Outside Diameter

**SECTION 14-14**

14. 1/2" (12.7 mm) Outside Diameter  
14. 1/2" (12.7 mm) Outside Diameter

**14. 1/2" (12.7 mm) Outside Diameter**

14. 1/2" (12.7 mm) Outside Diameter

**SECTION 15-15**

15. 1/2" (12.7 mm) Outside Diameter  
15. 1/2" (12.7 mm) Outside Diameter

**15. 1/2" (12.7 mm) Outside Diameter**

15. 1/2" (12.7 mm) Outside Diameter

**SECTION 16-16**

16. 1/2" (12.7 mm) Outside Diameter  
16. 1/2" (12.7 mm) Outside Diameter

**16. 1/2" (12.7 mm) Outside Diameter**

16. 1/2" (12.7 mm) Outside Diameter

**SECTION 17-17**

17. 1/2" (12.7 mm) Outside Diameter  
17. 1/2" (12.7 mm) Outside Diameter

**17. 1/2" (12.7 mm) Outside Diameter**

17. 1/2" (12.7 mm) Outside Diameter

**SECTION 18-18**

18. 1/2" (12.7 mm) Outside Diameter  
18. 1/2" (12.7 mm) Outside Diameter

**18. 1/2" (12.7 mm) Outside Diameter**

18. 1/2" (12.7 mm) Outside Diameter

**SECTION 19-19**

19. 1/2" (12.7 mm) Outside Diameter  
19. 1/2" (12.7 mm) Outside Diameter

**19. 1/2" (12.7 mm) Outside Diameter**

19. 1/2" (12.7 mm) Outside Diameter

**SECTION 20-20**

20. 1/2" (12.7 mm) Outside Diameter  
20. 1/2" (12.7 mm) Outside Diameter

**20. 1/2" (12.7 mm) Outside Diameter**

20. 1/2" (12.7 mm) Outside Diameter

**SECTION 21-21**

21. 1/2" (12.7 mm) Outside Diameter  
21. 1/2" (12.7 mm) Outside Diameter

**21. 1/2" (12.7 mm) Outside Diameter**

21. 1/2" (12.7 mm) Outside Diameter

**SECTION 22-22**

22. 1/2" (12.7 mm) Outside Diameter  
22. 1/2" (12.7 mm) Outside Diameter

**22. 1/2" (12.7 mm) Outside Diameter**

22. 1/2" (12.7 mm) Outside Diameter

**SECTION 23-23**

23. 1/2" (12.7 mm) Outside Diameter  
23. 1/2" (12.7 mm) Outside Diameter

**23. 1/2" (12.7 mm) Outside Diameter**

23. 1/2" (12.7 mm) Outside Diameter

**SECTION 24-24**

24. 1/2" (12.7 mm) Outside Diameter  
24. 1/2" (12.7 mm) Outside Diameter

» **As per ASTM C 411 testing**

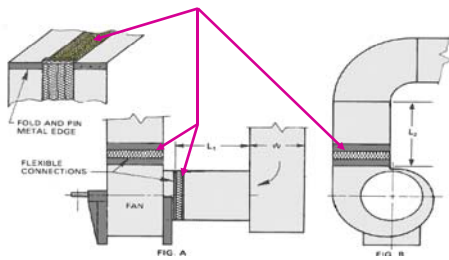
» **Divided by 2**





### Vibration Isolators

- **Section M1601.2.1** Formerly M1601.2.2 (2003 IRC)
  - **When prefabricated from approved material**
    - **May not exceed 10" in length**



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### Installation Of Ductwork

- **Joints & Seams – Section M1601.4.1**

Formerly M1601.3.1 in 2003 IRC

- **Joints are to be substantially air tight**
  - **Joint & Seam sealing**
    - Tapes, Mastics, Gasketing & other approved means
    - All methods to comply with their UL rating



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### Examples

- **Rigid Fibrous Glass Duct**
  - **Meets UL 181A**
    - **UL 181 A-P = Pressure Sensitive Tape**
    - **UL 181 A-M = Mastic**
    - **UL 181 A-H = Heat Sensitive Tape**
- **Flexible Air Ducts & Connectors**
  - **Meets UL 181B**
    - **UL 181 B-FX = Pressure Sensitive Tape**
    - **UL 181 B-M = Mastic**

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### Connections

- **Flange Connections**
  - **Duct to flange connections are to be mechanically fastened**
- **Crimp Joints For Round Ducts**
  - **Should have a 1.5 inch contact lap**
  - **Must be mechanically connected**
    - **Minimum fastening of**
      - **3 sheet met screws or rivets, equally spaced**



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### Duct Support

- **Support: Section M 1601.4.3**  
(2003 IRC Section M1601.3.2)
  - **Metal Duct support**
    - 0.5 inch wide number 18 gage metal strap
    - (or) 12 gage galvanized wire
    - At intervals of
      - Not exceeding 10 feet
  - **Non-metallic ducts**
    - To be supported as per MFG installation instructions
- **Duct Separation: Section M1601.4.7** (2003 IRC Section M1601.3.6)
  - Minimum of 4" from earth



85

### Do I Need To Fireblock?

- **Fireblocking - Section M1601.4.4**
  - Formerly M1601.3.3 in 2003 IRC
  - **Fireblock as per Section R602.8/R302.11**
    - As per number 4
      - At openings around vents, pipes, ducts, cables and wires at ceiling and floor level, with an approved material to resist the free passage of flame and products of combustion



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### Insulation Installation

- **Duct Insulation**
    - **Section M1601.4.5**  
(Formerly M1601.3.4 of 2003 IRC)
      - It shall be installed in accordance with three separate requirements
    - **Requirements**
      - **Vapor Retarder**
        - Maximum permeance of 0.05 perm
      - **Aluminum Foil**
        - Minimum thickness of 2 mils
    - **Both to be installed on the exterior of insulation**
      - On cooling supply ducts
        - Passing through unconditioned space
- Exception spray polyurethane foam with water vapor 3 perm/inch at installed thickness.



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### Insulation Installation

- **When Wall Or Floor Is Fireblocked**
    - Duct coverings are not to penetrate the wall or floor
  - **Exterior Duct System**
    - To be protected against the elements
- Would This System Meet Code??**



88



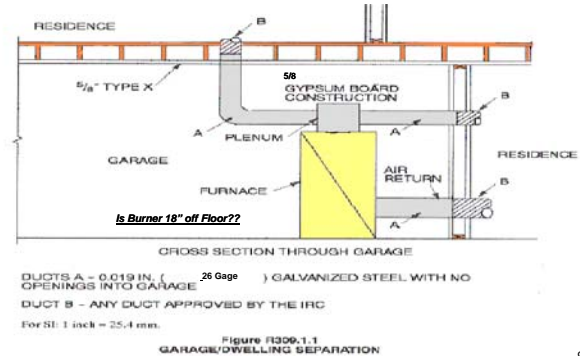
### Insulation Thickness

- **When Chapter 11 Of The 2009 IRC Is Used**
  - **For Energy Efficiency**
    - **Section N1103.2 Ducts -**
    - Section N1103.2.1 Insulation**
      - Supply Ducts in Attics shall be insulated to a minimum of R-8
      - All other ducts shall be insulated to a minimum of R-6
      - **Exception:**
        - » Ducts or portions thereof located completely inside the building envelope.



89

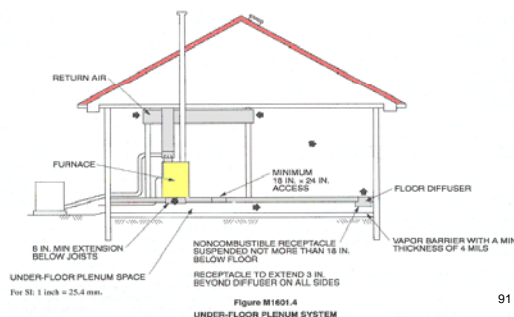
### Ducts In Garages



90

### Under Floor Plenums

- **Section M1601.5 (Formerly M1601.4 in 2003 IRC)**
  - **Underfloor space used as a supply plenum**
    - **Downflow / Counterflow furnace**



91

### Return Air

- **Return Air May Be Taken From**
  - **Inside the dwelling**
    - **Outside dilution air may be added**
- **Prohibited Sources – Section M1602.2**
  - **Outdoor and return air may not be taken from any of five locations**
    - **With some exceptions**

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### **Prohibited Sources**

- **No Air To Be Taken From**
  - **Within 10 foot minimum from**
    - **Appliance vent, Plumbing vent, Exhaust discharge**
      - Unless outlet is 3 feet above the air inlet
- **When Flammable Vapors Are Present**
  - **May not be less than**
    - **10 feet above a public way, or driveway**
  - **Nor less than 10 feet on grade location from**
    - **Sidewalk, street, alley or driveway**

93

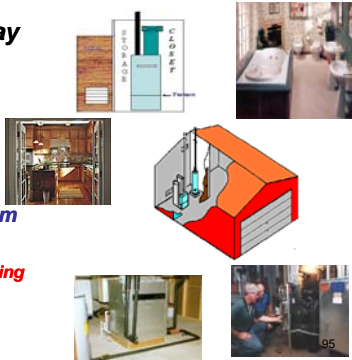
### **Prohibitions Continued**

- **If Room Or Space**
  - **Is less than 25% of the entire volume served**
    - **As per Manual D for room connections**
      - Adjoining rooms or spaces may be considered as a single room
  - **Exception**
    - **The 25% does not apply**
      - If the return air is less than or = to the amount of supply air to the room or space

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### **Prohibitions Continued**

- **No Return Air May Be Taken From**
  - **Closet**
  - **Bathroom**
  - **Kitchen**
  - **Garage**
  - **Mechanical Room**
  - **Furnace Room**
    - **Or another dwelling**



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### **Prohibited Sources**

- **Any Room Or Space With Fuel Burning Units**
  - **When the room serves as the sole source of return Air**
- **Exception**
  - **Direct vent or non-vented unit**
  - **Space volume exceeds**
    - **1 cubic foot for each 10 Btu/h of total input**
    - **Discharge air is = to supply air**
    - **Return air inlet not within 10 feet of firebox or draft hood**
  - **Solid fuel burning with return air inlet**
    - **Greater than 10 feet from firebox or draft hood**

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### **Combustion Air**

**Major Change in 2009 IRC from 2003 IRC**

- **Section M1701.1 Scope.**
  - **Solid-fuel burning appliances**
    - Shall be provided with combustion air in accordance with manufacturer's installations instructions.
  - **Oil-Fired appliances**
    - Shall be provided with combustion air in accordance with NFPA 31 - 2006
  - **Methods of providing combustion air in this chapter does not apply to fireplaces, fireplace stoves and direct-vent appliances**
  - **Gas-fired appliances shall be in accordance with Chapter 24 – Fuel Gas**

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### **Combustion Air - 2003 IRC**

- **Air Supply Section M1701.1**
  - **The section deals with liquid and solid fuel systems**
    - **It does not deal with Gas units**
- **Buildings Of Unusually Tight Construction**
  - **Combustion air is to be gotten from outside the sealed envelope**
- **Ordinary Tightness Is Based Upon**
  - **50 cu ft of air per 1000 Btu/h of total input**

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### **What Is**

- **Unusually Tight Construction**
  - **Construction meeting these requirements**
    - **Thermal envelope walls**
      - With a vapor retarder rating of 1 perm or less with gasketed or sealed openings
    - **Doors & openable windows meeting air leakage**
      - Requirements of IECC 502.1.4.1
    - **Applied caulking and sealants for joints, windows, door frames, plates**
      - Mechanical, electrical & plumbing penetrations and other openings

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### **Combustion Air (2003 IRC)**

- **Prohibited Sources Section M1701.4**
  - **Areas where a fan may cause adverse conditions**
  - **Areas with flammable vapors**
  - **Fuel fired systems may not get air from**
    - **Sleeping rooms**
    - **Bathrooms**
    - **Toilet Rooms**
  - **Exceptions**
    - **If solid fuel, provided it is not a conditioned space**
    - **If all air is from outdoors and enclosure uses**
      - **Solid weather stripped door with self closure**

100



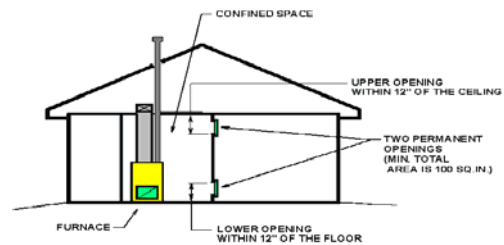
### **All Air From Inside The Building** **(2003 IRC)**

- **Required Volume**
  - This method may be used if the following are met
    - Volumetric space is greater than 50 cu ft per 1000 Btu/h of total input
      - Building is of Ordinary Tightness
  - Communicating rooms may be used
    - If they communicate directly through openings
      - With no doors

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### **Confined Space (2003 IRC)**

- **Section M1702.2**
  - Opening dimensions for each opening
    - 1 sq in / 1000 Btu/h of total input
      - Minimum of 100 sq in per opening



102

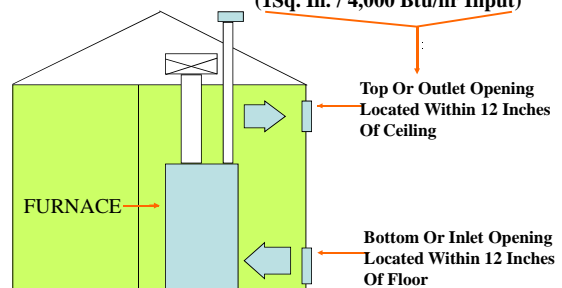
### **Outdoor Air (2003 IRC)**

- **All Air From Outdoors M1703**
  - Two openings or ducts - Section M1703.2
    - Location
      - Within 12" of the top
      - Within 12" of the bottom
    - May be direct connections to
      - Outdoors, Ventilated Attic, Ventilated Crawl Space
    - Opening size
      - Vertical Ducts = 1 sq in per 4000 Btu/h total input
      - Horizontal Ducts = 1 sq in per 2000 Btu/h total input
      - Minimum cross sectional dimension of rectangular duct to = 3 inches

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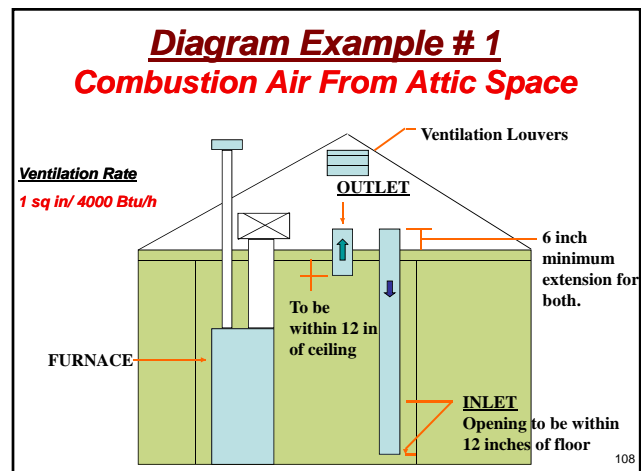
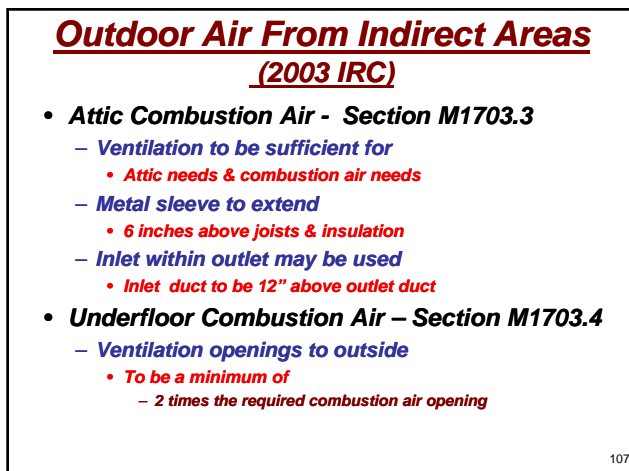
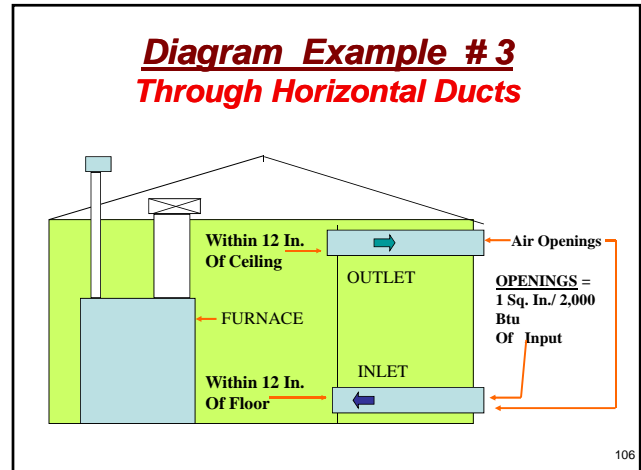
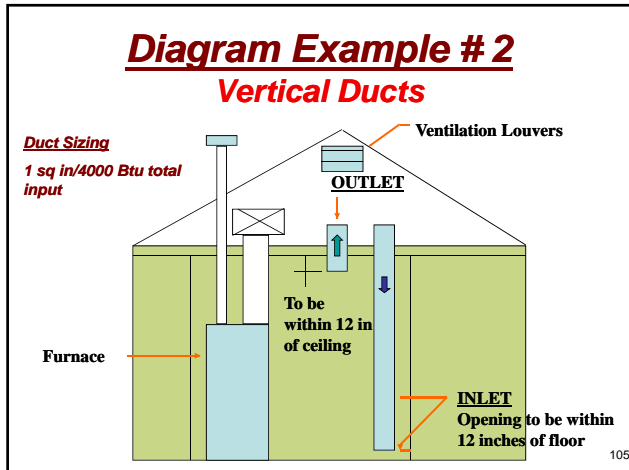
### **Diagram Example #1** **DIRECT OPENINGS (100% Outside Air)**

2 Permanent Openings Each Sized  
(1Sq. In. / 4,000 Btu/hr Input)

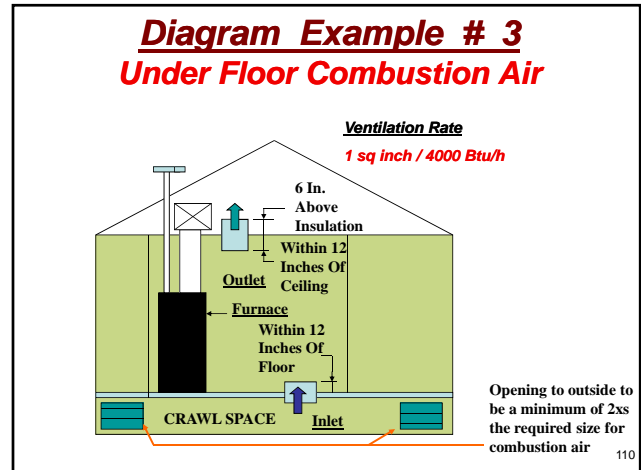
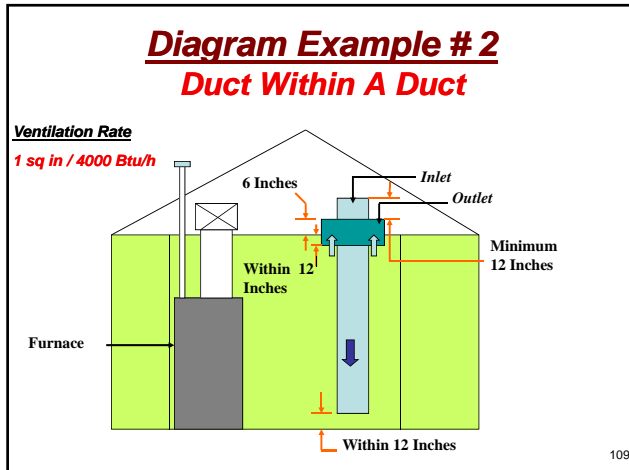


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## 2009 IRC - NFPA 31- 2006 Chapter 5 Air for Combustion and Ventilation

- **Section 5.2 Basic Requirements**
  - Appliances located not to interfere with supply of air within space
  - Outside air shall be introduced where tight buildings' normal infiltration does not provide sufficient combustion air
  - Ducts from outdoors same cross-sectional area as free area of openings to which they connect
  - Smallest dimension of rectangular air ducts not less than 3 in.
  - Residential requirements of 5.2.1 permitted to be met by either Section 5.3 or 5.4

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## 2009 IRC - NFPA 31- 2006 Chapter 5 Air for Combustion and Ventilation

- **Section 5.3 Appliances Located in Unconfined Spaces**
  - Section 5.3.1: In unconfined spaces in buildings of conventional frame, brick or stone construction
    - Air for combustion and ventilation shall be permitted to be supplied by normal infiltration
  - Section 5.3.2: If Normal Infiltration is not sufficient because of TIGHT Construction
    - Air for combustion and ventilation shall be obtained directly from outdoors
    - Or from spaces that freely communicate with outdoors by means of permanent opening or openings having a total free area not less than 1 in<sup>2</sup> per 5000 Btu/hr based on input rating of all appliances in space

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## 2009 IRC - NFPA 31- 2006 Chapter 5 Air for Combustion and Ventilation

### • Section 5.4 Appliances Located in Confined Spaces

- Section 5.4.1: All Air Taken from Inside the Building
  - The confined space shall be provided with 2 openings see figure 5.4.1.1, one near top of space and one near bottom
- Section 5.4.2: All Air Taken from Outdoors
  - The confined space shall be provided with 2 openings, one near top of space and one in or near bottom
  - The openings shall communicate directly or by means of ducts with the outdoors or to spaces such as attics or crawl space that freely communicate with outdoors
- Section 5.4.3: Air Taken from Inside the Building – Combustion Air Taken from Outdoors
  - The confined space shall be provided with 2 openings ...

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## NFPA 31- 2006 Section 5.4.1 All Air Taken from Inside the Building

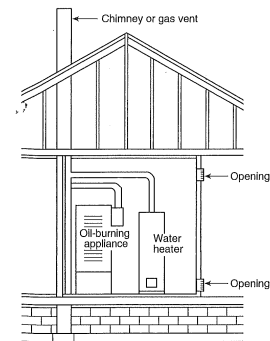


FIGURE 5.4.1.1 Appliances Located in Confined Spaces — All Air Taken from Inside the Building.

114

## NFPA 31- 2006 Section 5.4.2 All Air Taken from Outdoors

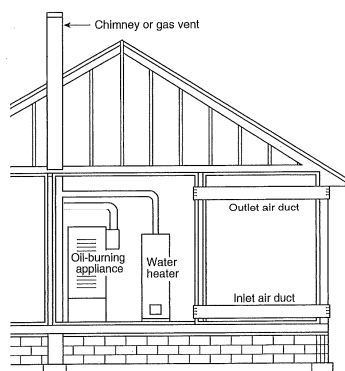


FIGURE 5.4.2.2(a) Appliances Located in Confined Spaces — All Air from Outdoors.

115

## NFPA 31- 2006 Section 5.4.2 All Air Taken from Outdoors

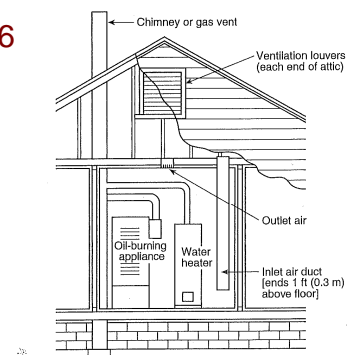


FIGURE 5.4.2.2(b) Appliances Located in Confined Spaces — All Air from Outdoors Through Ventilatted Attic.

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**NFPA 31- 2006**  
**Section 5.4.2**  
**All Air Taken**  
**from Outdoors**

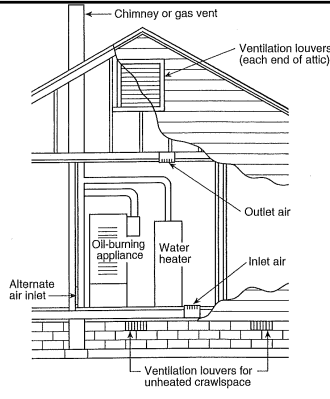
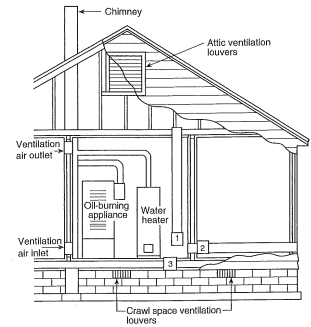


FIGURE 5.4.2.2(c) Appliances Located in Confined Spaces  
— All Air from Outdoors, with Inlet Air from Ventilated Crawl Space and Outlet Air to Ventilated Attic.

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**NFPA 31- 2006**  
**Section 5.4.3**  
**Ventilation Air**  
**Taken from Inside**  
**the Building –**  
**Combustion Air**  
**Taken from**  
**Outdoors**



Note: Ducts used for make-up air can be connected to the cold air return of the heating system only if they connect directly to outdoor air.  
Nos. 1, 2, and 3 mark alternate locations for air from outdoors.

FIGURE 5.4.3.1 Appliances Located in Confined Spaces, with Ventilation Air from Inside Building and Combustion Air from Outside, Ventilated Attic, or Ventilated Crawl Space.

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**Combustion Air For Gas**

- **Chapter 24 Fuel Gas**
  - *Uses the same methods as chapter 17 (2003 IRC)*
    - *With a few additions*
- **Combining Spaces In Different Stories**
  - **Section G2407.5.3.2**
    - *Allows for the use of a second story for combustion air under ordinary tightness*
    - *1 or more openings in*
      - *Doors and floors*
      - *Total free area of 2 sq in per 1000 Btu/h total input*

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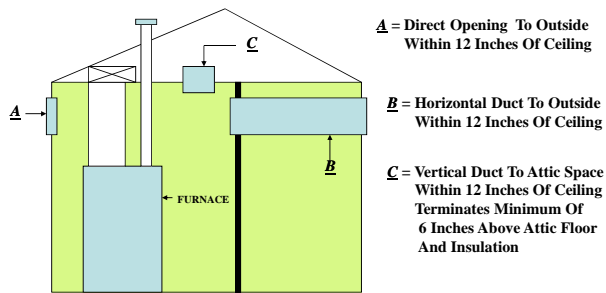
**One Opening For Outside Air**

- **One Permanent Opening Method - Section G2407.6.2**
  - **Allows for one opening**
    - *Within 12" of the top of the enclosure*
    - *Opening size of*
      - *1 sq inch per 3000 Btu/h of total input*
  - **Equipment within enclosure minimum clearances of**
    - *1" sides and back*
    - *6" in front*

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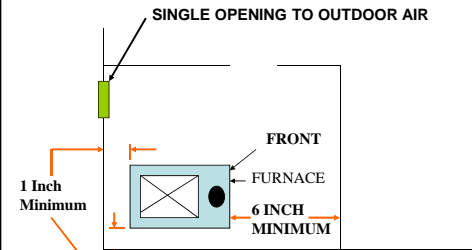


### One Opening Placement



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### Enclosure Clearances



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### Use Of Indoor & Outdoor Air

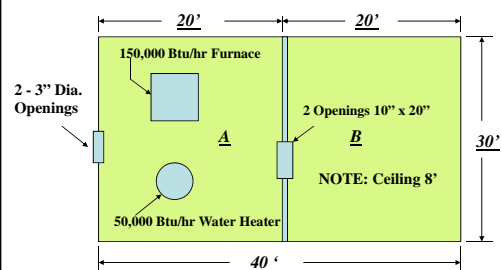
#### • Outdoor Opening Calculation – Section G2407.7.3

##### – Calculation of opening size

- Interior ratio shall be
  - Available volume / Required volume
- Outdoor size reduction factor
  - 1 minus ratio of interior space
- Minimum outdoor opening size
  - Size as determined by section G2407.6
    - » Times the reduction factor
  - NOTE: Minimum dimension not to be less than 3 inches

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### Example Problem



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**Do The Openings To The Outdoors,  
Combined With The Volumes Of A & B  
Meet Combustion Air Demand?**

- Volume Of "A":
  - 4800 Cubic Feet
- Volume Of "B":
  - 4800 Cubic Feet
- Area Of The 3" Diameter Opening:
  - 7.07 Square Inches
- Area Of Each Opening Between A & B:
  - 200 Square Inches

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**Problem Continued**

- TOTAL INPUT:
  - 200,000 Btu/hr
- Question
  - Do "A" & "B" meet the volumetric requirements of G2407.5?
    - Required Volume =
      - 10,000 Cu.Ft.
    - Available Volume =
      - 9,600 Cu. Ft.

• NO

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**Problem Continued**

- Question
  - Do openings between "A" & "B" meet requirements of G2407.5.3
- Required Area =
  - 200 Square Inches
- Actual Area =
  - 200 Square Inches
    - For Each Opening

• YES

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**Problem Continued**

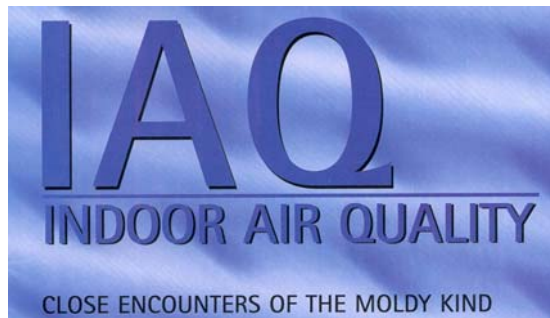
- Determine The Required Area Of Each Outdoor Opening?
  - Required Area =
    - $(200,000 / 4000) \times 1 \text{ sq in} =$ 
      - 50 Sq in Required (as per G2407.6.1)
- Determine If The 3 Inch Diameter Openings Along With the Interior Openings Comply?
  - $[(1) - 9600 / 10000] \times 50 =$ 
    - $0.04 \times 50 = 2 \text{ sq. in.}$ 
      - (As per G2407.7.3)

• OK

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### How Does All This Fit In With



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### Tying The Ends Together

- **Single Code Requirements**
  - Will not stop Indoor Air Quality problems
- **All Code Requirements Together**
  - Ventilation, Exhaust, Proper Duct Design
    - Will keep the Residential Building free of
      - Contaminants
      - Moisture
      - Mold
      - Hazardous Products
    - Promoting a healthy and safe environment



### What Does The Future Hold



- **ASHRAE Standards Are In The Lead**
  - **ASHRAE Standard 62.2 – 2003**
    - Ventilation & Acceptable Indoor Air Quality for Low-Rise Residential Buildings
      - Leads the way in Residential IAQ through
        - » Ventilation, Exhaust & Ducting
    - Maine is in the process of adopting this standard for their new Building Code
    - Newer codes will be using this standard
      - In its complete or a partial form

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### Questions??



#### **CT Department of Public Safety Division of Fire, Emergency and Building Services**

- Office of the State Building Inspector  
(860) 685 - 8310
- Office of the State Fire Marshal  
(860) 685 - 8350
- Office of Education and Data Management  
(860) 685 - 8330

<http://www.ct.gov/dps/>

Thank-you !

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